A Rational invasive species control policy

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The Drivers of the Invasive Pest (IS) Problems

- Globalization
  - International trade
  - Tourism/International travel
- Climate change
- Terrorism

Each of these drivers has to be analyzed with respect to:

- Pathways and spread of invasive pests
- Their impact
- Actions to control invasive species

Features of Research on IS

- Data-driven
- Research-oriented
- Interdisciplinary

Aspects of research to be emphasized are:

- Dynamics
- Spatial spread
- Risk and uncertainty

Globalization and IS

- Migration of species is not always bad. It can be very beneficial.
- The diffusion of species over space has been a critical driver of history.
- The mustangs of the Americas originated in Asia.
- Tomatoes and potatoes migrated from the New World to the Old World.
- Species transfer like technology transfer can do much good.
- However, it can cause disease and losses,e.g. global spread of infection over time.

Fear of Invasive Species May Lead to "Biological Autarky."

- A response to the danger of infestation, invasive species, etc., is "biological autarky."
  - Restrict the transfer, ban, and exchange materials to preserve "genetic purity."
  - Rely only on native plants and species.
- Banning & heavy restriction of material movement is inefficient (civilizations that took advantage of biological diffusion of beneficial species and genetic materials thrived, ("Guns,Germs and Steel"))
- Need to balance benefits and cost of genetic transfers

Welfare Economic Perspective: Regulating Invasive Pests

- Gov't maximizes social welfare subject to constraints
- Social Welfare is sum of expected value of:
  - Consumer surplus (food consumption, low prices, safety)
  - Producer surplus
    - Grower profits (crop losses, treatment costs, increased revenue)
    - Agribusiness profit (revenue losses, damage control costs)
  - Net gov't expenditures
    - Monitoring and treatment costs (outside and inside the country and at the border)
    - Revenues from penalties

Policy Constraints

- Budget of regulatory agencies
- Behavior of economic agents
  - Profit maximizing importers adjust to regulation
    - Due care and safety enhancing innovation
    - Product modification and supply management leading to reduced quality, supply, and choice
    - Smuggling, falsifying documents
    - Port shopping
  - Profit maximizing growers
    - Control of invasive species
    - Modify crop selections
  - Surplus maximizing consumers
    - Concern about pesticide residue and drift
    - Modify consumption patterns

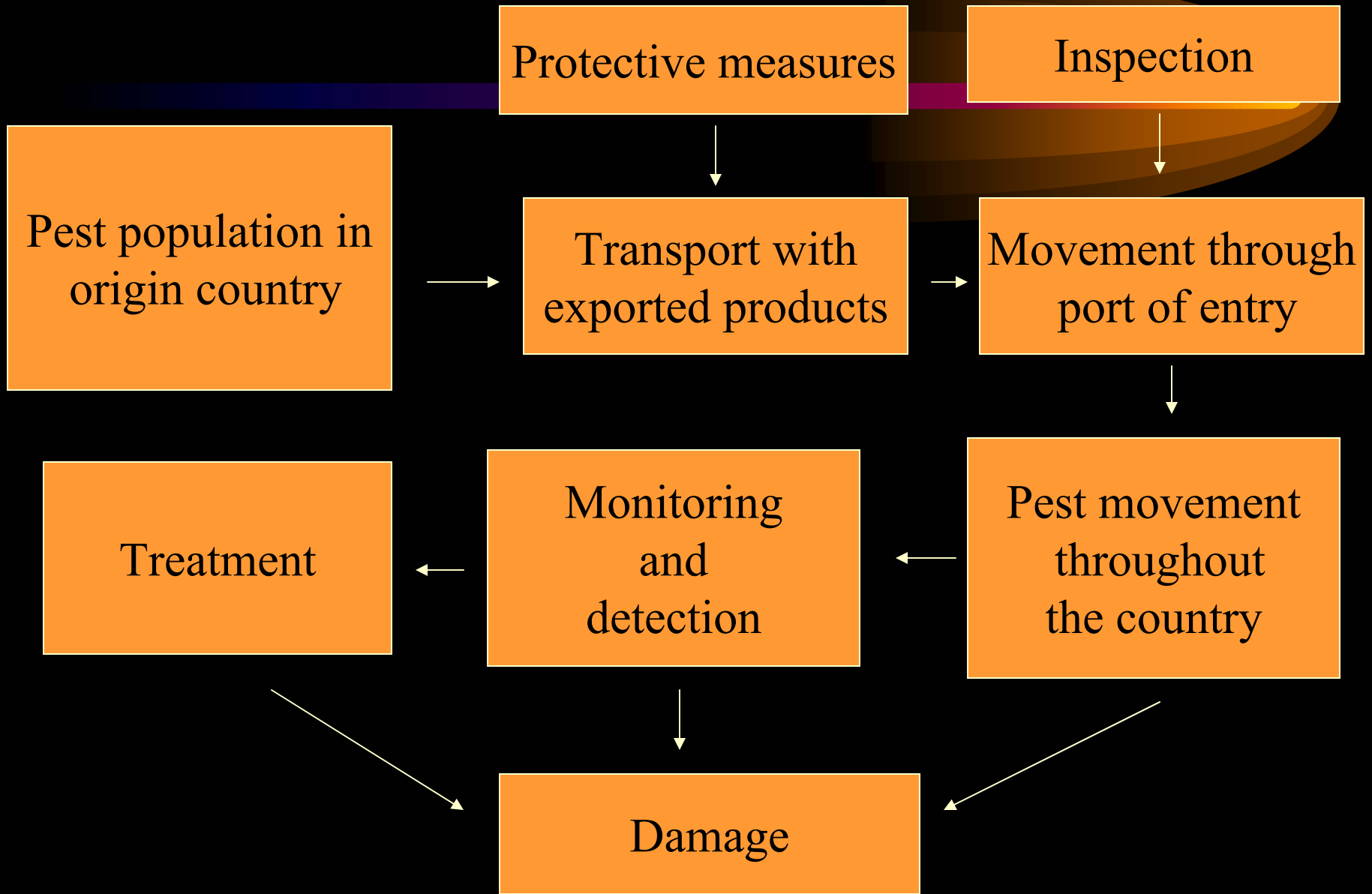
Policy Constraints (continued)

- Market clearing relationships
  - Output supply
  - Input demand
- Political and legal constraints
  - Trade regulation & trade partner behaviors (retaliation)
  - Constrained capacity to impose liabilities
  - Political lobbying and rent seeking
- Technological constraints
  - Limited monitoring & detection capacity
  - Pest treatment
- Informational constraint
  - Uncertainty about performance (who did what)
  - Uncertainty about technological & biological processes

Research Challenges

- Population movement processes
- Balancing incentives, monitoring & control
- Technological options: present & future
- Address issues of terrorism and climate change
- Impacts on markets of changes of supply
- Attitudes to and cost of pest control efforts

Population movement processes: Driven by biology and economics



Balancing incentive, monitoring & control

	Incentives	Monitoring	Control
Pre-shipment	Rejection of imports	Overseas sampling	Required pretreatment
Border	Rejection & fines	Inspections & sampling	Treatment
Post border movement & pest population	Subsidies farmers detection & protection	Detection	Protective spraying , control and eradication effort

Technological Options: present & future

- Need estimates of effectiveness, cost, and side effects of:
  - Monitoring technologies
  - Treatment technologies
- Need assessment of state of knowledge & likelihood of new monitoring & treatment technologies
  - Regulatory requirements and incentives are technology dependent

Trade and IS

- To large extent -migration of invasive species is an unintentional by product of trade and globalization
- Traders want to maximize profits- pests may " take the ride" within the product or inside the vessel
- The exporter can reduce likelihood and magnitude of population movement-but pest control is costly
- The exporter need incentives to reduce movement of species with trade-but these efforts needed to be monitored and complemented by other protective action

Travelers as Carriers of IS

- Travelers move species across borders for self interest
  - Some may be unaware of danger, or believe that they can control it
  - Other are aware but try to smuggle
- Control of likelihood and magnitudes of transfer through travel cane be done by
  - education about possible side effects
  - Detection effectiveness
  - Incentives(penalties)
- Detection effort design should balance
  - Gains from risk reduction
  - Benefits of transfers to traveler (do not over-regulate)
  - Cost of inconvenience and transaction to others

Terrorism & IS

- Unlike trade, for terrorists are not externalities, they are the real deal
- Terrorists may exploit trade pathways
  - Benefits of inspection and control include gains from reduction of expected terror damage
- The optimization of the terrorist is another constraint in designing policy
  - Terrorists want to maximize impact minus costs of effort & being caught

Climate Change & IS

- Climate serves as a barrier to pest movement
- Changes in climate patterns should be trigger reevaluation of invasive species policies
- With global warming, pest vulnerability is likely to increase & may see inter-regional movement of pests

Scale &time effect in IS control

- Border and shipment control activities should be designed to
  - take advantage of synergies in controlling transfer of IS
  - Identify cost effective efforts aimed at special pathways
- Procedures should be established for **fast** establishment of inland pest detection, control and eradication
- Emphasis should be given to learning, documentation and policy reassessment & adaptation
  - Data bases on results of detection and control effort should be established
  - Ex post evaluation should be past of the process. Good policy design needs feedback
- Biological knowledge For IS is useful and complementary I to information for bio control and biodiversity. An integrated bio-information collection will be useful

Risk and uncertainty issues

- Invasive species impacts are difficult to predict for several reasons
  - Random effects
  - Heterogeneity
  - Lack of knowledge(estimates subject to error)
- Need to
  - emphasize consistent procedure for reporting reliability of statistical estimates
  - Develop impact estimates for various populations
  - Develop estimates of impact under alternative values of critical sources of variability
- Consider risk concerns and develop policies to address low probability high impact situations
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Priorities in ES research

- The question facing gov't frequently is which IS target and at what intensity
- Economics can help in setting the priorities
- For each IS one needs
  - stylized facts - type of impacts, crops,locations
  - Establish a simple micro model fitting the type of impact considered- no one model fits all (modeling Gypsie moss is different than fruit fly)
  - Obtain basic numbers for simulations to estimate orders of magnitudes of damage
  - Identify the big problems and study then in detail

Other Issues

- Federal & state sharing of responsibility
- Private sector activities
- Invasive species vs. trade liberalization
- Beyond agriculture
  - Human health
  - Natural resource damages
  - Urban landscape